

Pre-AP Geometry 2-2 Study Guide: Conditional Statements (pp 81-83)

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Attendance Problems. Determine if each statement is true or false.

1. The measure of an obtuse angle is less than 90° .
 2. All perfect-square numbers are positive.
 3. Every prime number is odd.
 4. Any three points are coplanar.
- I can identify, write, and analyze the truth value of conditional statements.
 - I can write the inverse, converse, and contrapositive of a conditional statement.

Vocabulary		
conditional statement	hypothesis	conclusion
truth value	negation	converse
inverse	contrapositive	logically equivalent statements

Common Core

- CC.9-12.G.CO.9** Prove theorems about lines and angles.
- CC.9-12.G.CO.10** Prove theorems about triangles.
- CC.9-12.G.CO.11** Prove theorems about parallelograms.
- CC.9-12.G.SRT.4** Prove theorems about triangles.

Teacher: Which month has 28 days?

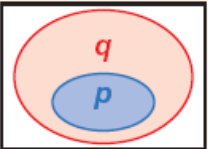
Student: All of them!

I know engineers. They love to change things. - Dr. McCoy

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Conditional Statements

DEFINITION	SYMBOLS	VENN DIAGRAM
A conditional statement is a statement that can be written in the form "if p , then q ."	$p \rightarrow q$	
The hypothesis is the part p of a conditional statement following the word <i>if</i> .		
The conclusion is the part q of a conditional statement following the word <i>then</i> .		

Video Example 1. Identify the hypothesis and conclusion of each statement.

A. If Ed has a test, then he will study.

B. A number is a real number if it is a rational number.

1 Identifying the Parts of a Conditional Statement

Identify the hypothesis and conclusion of each conditional.

A If a butterfly has a curved black line on its hind wing, then it is a viceroy.

Hypothesis: A butterfly has a curved black line on its hind wing.

Conclusion: The butterfly is a Viceroy.

B A number is an integer if it is a natural number.

Hypothesis: A number is a natural number.

Conclusion: The number is an integer.

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Example 1. Identify the hypothesis and conclusion of each statement.

A. If today is Thanksgiving Day, then today is Thursday.



B. A number is a rational number if it is an integer.

5. Guided Practice: Identify the hypothesis and conclusion of the statement: A number is divisible by 3 if it is divisible by 6.

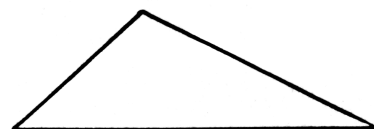
Writing Math

"If p , then q " can also be written as "if p , q ," " q , if p ," " p implies q ," and " p only if q ."

Many sentences without the words *if* and *then* can be written as conditionals. To do so, identify the sentence's hypothesis and conclusion by figuring out which part of the statement depends on the other.

Video Example 2. Write a conditional statement from the sentences.

A. An obtuse triangle has exactly one obtuse angle.

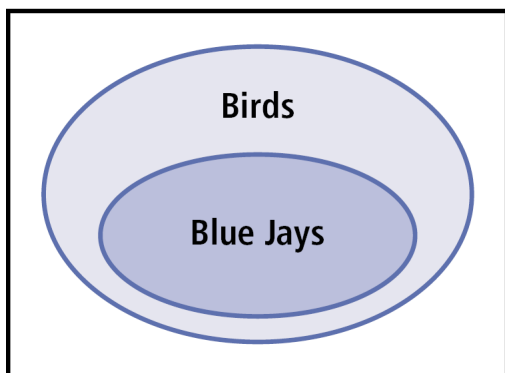


Obtuse.

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B.

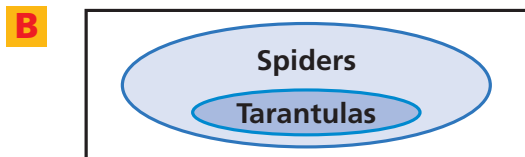


2 Writing a Conditional Statement

Write a conditional statement from each of the following.

- A** The midpoint M of a segment bisects the segment.
The **midpoint M of a segment** *Identify the hypothesis*
bisects the segment. *and conclusion.*

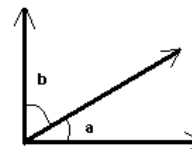
Conditional: If M is the midpoint of a segment,
then M bisects the segment.



The **inner** oval represents the **hypothesis**, and the **outer** oval represents the **conclusion**.

Conditional: If an animal is a tarantula, then it is a spider.

6. Guided Practice: Write a conditional statement from the sentence: Two angles that are complementary are acute.



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A conditional statement has a _____ of either true (T) or false (F). It is false only when the hypothesis is true and the conclusion is false. To show that a conditional statement is false, you need to find only one counterexample where the hypothesis is true and the conclusion is false.

Video Example 3. Determine if the conditional is true. If false, give a counterexample.

A. If this month is April, then next month is May.



B. If a quadrilateral has 4 90° angles, then it is a square.

C. If 121 is a prime number then 10 is a multiple of 3.

3 Analyzing the Truth Value of a Conditional Statement

Determine if each conditional is true. If false, give a counterexample.

A If today is Sunday, then tomorrow is Monday.

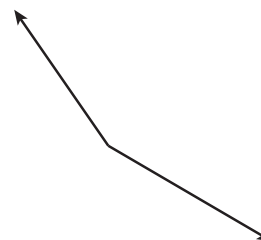
When the hypothesis is true, the conclusion is also true because Monday follows Sunday. So the conditional is true.

B If an angle is obtuse, then it has a measure of 100° .

You can draw an obtuse angle whose measure is not 100° . In this case, the hypothesis is true, but the conclusion is false. Since you can find a counterexample, the conditional is false.

C If an odd number is divisible by 2, then 8 is a perfect square.

An odd number is never divisible by 2, so the hypothesis is false. The number 8 is not a perfect square, so the conclusion is false. However, the conditional is true because the hypothesis is false.



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Example 3. Determine if the conditional is true. If false, give a counterexample.

A. If this month is August, then next month is September.



B. If two angles are acute, then they are congruent.

C. If an even number greater than 2 is prime, then $5 + 4 = 8$.

7. Guided Practice: Determine if the conditional “If a number is odd, then it is divisible by 3” is true. If false, give a counterexample.

(p 85) 13, 15, 17, 18, 19, 21.

Remember!

If the hypothesis is false, the conditional statement is true, regardless of the truth value of the conclusion.

8. What is a negation?

9. What is the symbol for a negation?

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Related Conditionals	
Definition	Symbols
A conditional is a statement that can be written in the form "If p , then q ."	$p \rightarrow q$

Related Conditionals	
Definition	Symbols
The <u>converse</u> is the statement formed by exchanging the hypothesis and conclusion.	$q \rightarrow p$

Related Conditionals	
Definition	Symbols
The <u>inverse</u> is the statement formed by negating the hypothesis and conclusion.	$\sim p \rightarrow \sim q$

Related Conditionals	
Definition	Symbols
The <u>contrapositive</u> is the statement formed by both exchanging and negating the hypothesis and conclusion.	$\sim q \rightarrow \sim p$

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Video Example 4. Write the converse, inverse, and contrapositive of the conditional statement “If an animal is a dog, then it has four legs.” Find the truth value of each.



4 Biology Application

Write the converse, inverse, and contrapositive of the conditional statement. Use the photos to find the truth value of each.

If an insect is a butterfly, then it has four wings.

If **an insect is a butterfly**, then **it has four wings**.

Converse: If **an insect has four wings**, then **it is a butterfly**.

A moth also is an insect with four wings.
So the converse is false.

Inverse: If **an insect is not a butterfly**, then **it does not have four wings**.

A moth is not a butterfly, but it has four wings. So the inverse is false.

Contrapositive: If **an insect does not have four wings**, then **it is not a butterfly**.

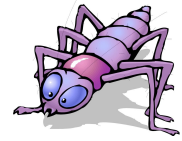
Butterflies must have four wings. So the contrapositive is true.



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Example 4. Write the converse, inverse, and contrapositive of the conditional statement “*If an animal is an adult insect, then it has six legs.*” Find the truth value of each.

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10. Guided Practice: Write the converse, inverse, and contrapositive of the conditional statement “If an animal is a cat, then it has four paws.” Find the truth value of each.



11. What are logically equivalent statements?

12. Which statements are logically equivalent?

Helpful Hint

The logical equivalence of a conditional and its contrapositive is known as the Law of Contrapositive.

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2-2 Conditional Statements (p 85) 13, 15, 17, 18, 19, 21, 22, 23, 36-38, 40, 44, 46, 48, 49, 54, 55, 57.

